

## FIRE DANGER RATING POCKET CARD FOR FIREFIGHTER SAFETY

Patricia L. Andrews<sup>1</sup>, Larry S. Bradshaw<sup>1</sup>, David L. Bunnell<sup>2</sup>, Gary M. Curcio<sup>3</sup>

<sup>1</sup>Rocky Mountain Research Station, USDA Forest Service  
Missoula, Montana

<sup>2</sup>Fire and Aviation Management USDA Forest Service  
Boise, Idaho

<sup>3</sup>North Carolina Division of Forest Resources.  
Kinston, North Carolina

### 1. INTRODUCTION

Awareness of environmental conditions and potential fire behavior is the responsibility of people at every level of the wildland fire organization—of the national coordinator who sets priorities for resource allocation, of the local manager who institutes fire prevention measures, of the incident management overhead team who manages fire suppression efforts and, very important, of the firefighter who must constantly make strategic, tactical, and personal safety decisions. In a memo of May 12, 1995, the Secretaries of the Departments of Agriculture and Interior stated: "The commitment to and accountability for safety is a joint responsibility of firefighters, managers and administrators... Individuals must be personally committed and responsible for their own performance and accountability."

The firefighter is directed by one of the ten standard fire orders to "Initiate all action based on current and expected fire behavior (NWCG 1989). A firefighter uses training and personal experience to assess potential fire behavior. 'Firefighters having too little experience' was, however, among the top 12 issues rated by 1000 firefighters as having the greatest impact on safety in a study designed to examine the Federal wildland firefighting community and to improve firefighter safety (TriData 1995). The Federal Wildland Fire Management review report (USDI/USDA 1995) notes that "in some cases agency administrators and fire management officers do not have the same level of experience in fire management oversight as did their predecessors." In addition, a national firefighting program often takes people to areas of the country where their experience may not apply, or may even be misleading, and the firefighters may not be fully aware of the status of the fire season.

Supplementing the firefighters' personal experience and training with other relevant information should improve safety. We present one way to provide such information on fire danger rating.

Although the National Fire Danger Rating System (NFDRS) is used routinely by dispatchers and coordinators, the information is not necessarily used or interpreted by the firefighter. A simple pocket card would provide NFDRS information about fire potential, leading to greater awareness and subsequently to better decisions and increased firefighter safety. The card we have designed helps the firefighter to compare the current fire season with those of the past and to see, for example, whether new extremes are being reached or whether fire danger is lower than average for the time of year. And the card helps them interpret fire danger values through association with past fires. Using the pocket card, each firefighter evaluates the meaning of NFDRS index values and personally produces and tracks the current season trend with a visual display.

Preparation and distribution of the card addresses the observation by Orosco and Jiron (1995) that "...fire management officers and dispatchers can help provide information that would result in more informed decision-making for firefighters... Those on the fireline need all the help they can get, especially in threshold fire behavior conditions such as in 1994. Recognition of these conditions by fire management and line officers is key in delivering support to fireline personnel to ensure fire safety."

### 2. NATIONAL FIRE DANGER RATING SYSTEM

NFDRS gives seasonal trends for fire potential for large areas, quantifying weather trends for an area in terms of an index (Deeming and others 1977). It is used for presuppression, dispatch, and generally for tracking the fire season. We feel that interpreting fire danger information can also help firefighters evaluate fire potential and increase firefighter safety and fire suppression success during initial attack.

Following issuance of the South Canyon Investigation Report (USDA/USDI 1994a), the Director

of the Bureau of Land Management and the Chief of the Forest Service established an Interagency Management Review Team (IMRT). Among the team's tasks was to identify significant issues and concerns related to interagency wildland fire management programs and recommend ways to address these issues and concerns. The recommendations in the IMRT report (USDA/USDI 1994b) included application of NFDRS: "improve the way agencies predict fire danger by making the danger rating systems more understandable and easier to use, and then train people in how to use these systems and interpret the results." And "Current fire danger levels will be compared to historic averages and worse case conditions, and the selection of appropriate suppression responses will be adjusted on the basis of this information." Creating NFDRS products in a form that can be used by firefighters in part addresses these issues.

Firefighters learn to assess potential fire behavior by being aware of the elements of the fire environment triangle (fuel, weather, and topography) their interactions, and their influence on fire behavior. For example, they learn how topography influences weather and fire behavior, that the character of the fire can change quickly under the influence of thunderstorm winds or a passing front, and that a dramatic change in fire behavior occurs when live fuel becomes involved in the fire. Such on-site evaluations are a critical ongoing activity for every firefighter.

We present the fire danger rating pocket card as information in support of and in addition to — definitely not instead of — on-site assessment of fire potential. NFDRS does not predict fire behavior. Rather, it focuses on the weather leg of the fire environment triangle, with fuel and slope factors essentially considered constant in the computations. Indexes are based on afternoon weather readings taken at fixed weather stations and on National Weather Service zone forecasts.

NFDRS offers several indexes and fuel models from which to choose. Local managers determine which to use in preparing the cards — Energy Release Component (ERC), Burning Index (BI), Keetch-Byram Drought Index (KBDI), large dead fuel moisture (1000h), and so on. ERC is often a good indicator of fire potential and shows seasonal trends when a fuel model with heavy dead fuels is used. KBDI is often used in the Southeastern United States. BI reflects changes in fine fuel moisture content and windspeed and is sometimes used in rangelands. The most appropriate fuel model and index for an area should be used. Determination of what is the most appropriate can be made through a comparison of historical indexes and fire activity using the computer program FIRES: Fire Information Retrieval and Evaluation System (Andrews and Bradshaw 1997). FIRES also allows visual comparison of seasons and indexes and provides methods for determining critical levels of fire danger.

To avoid confusion or conflicting messages, it is

important that the fuel model and index used to produce the cards be the same as those used for the fire danger values read over the radio. In addition, we suggest that, to avert confusion, cards be distributed for only one fuel model and index for an area.

### **3. GETTING THE INFORMATION TO THE FIREFIGHTER**

NFDRS information rarely makes it to the firefighter except possibly as a number read over the radio or as a chart in a briefing room. NFDRS is useful to the firefighters only if it is easy to interpret and use. A single NFDRS index number without points of reference gives little information and due to the high probability of misinterpretation, it may in fact be worse than no information. But that same index value can be meaningful when it is compared to values from previous fire seasons, to a historical maximum and to the trend for the current season. Comparison to something that is known aids interpretation of NFDRS in a relative sense.

When training firefighters in use of the card, the importance of local variability should be emphasized — the fact that NFDRS does not reflect variability in fuel, weather, and topography. The emphasis of the briefing should be on firefighter use of NFDRS for trends and comparisons. The distinction should be made between fire danger rating and fire behavior prediction. The importance of local weather forecasts should be emphasized. Firefighters should be encouraged to listen for daily indexes and forecasts and to plot the values throughout the fire season. Active involvement can only increase awareness.

### **4. FEATURES OF THE CARD**

Local fire managers produce the cards and tailor them to meet local needs. The prototype in figure 1 provides ideas for preparation. Following are some of the features of our prototype.

**Portable and durable** — The card is pocket-sized and laminated with material that can be written on so that the firefighter can track day-to-day fire danger levels. The card is folded, providing room for two fire danger plots on one side with notes, interpretation, and explanation on the other.

**Area of application** — A map shows the weather station location and the area of application. The area may be related to a fire weather forecast zone or to an administrative area such as a National Forest or county protection zone.

**Color** — Color is an important feature of the card although it doesn't show in the black and white figure in this paper. Fire danger levels are indicated on the fire season plots by background shading from green through yellow to red. To avoid absolute interpretation of numerical values, lines are not drawn for levels of fire danger (low moderate, high, very high, extreme). We

chose to include only the 97<sup>th</sup> percentile line on the prototype.

Past fire seasons - The top plot has historical maximum, average, and a locally determined critical level (such as 97<sup>th</sup> or 95<sup>th</sup> percentile) The average line gives an indication of the general fire season for the area. The maximum line indicates the recorded high for each day of the season. The second chart shows specific years; in this case a high and a low fire danger year. Years of recent memory give the firefighter a point of personal reference.

Past fires - To help the firefighter relate fire danger rating values to real-world experience, fire danger values associated with past fires that exhibited extreme fire behavior or with periods of high fire activity are plotted and are described on the back of the card.

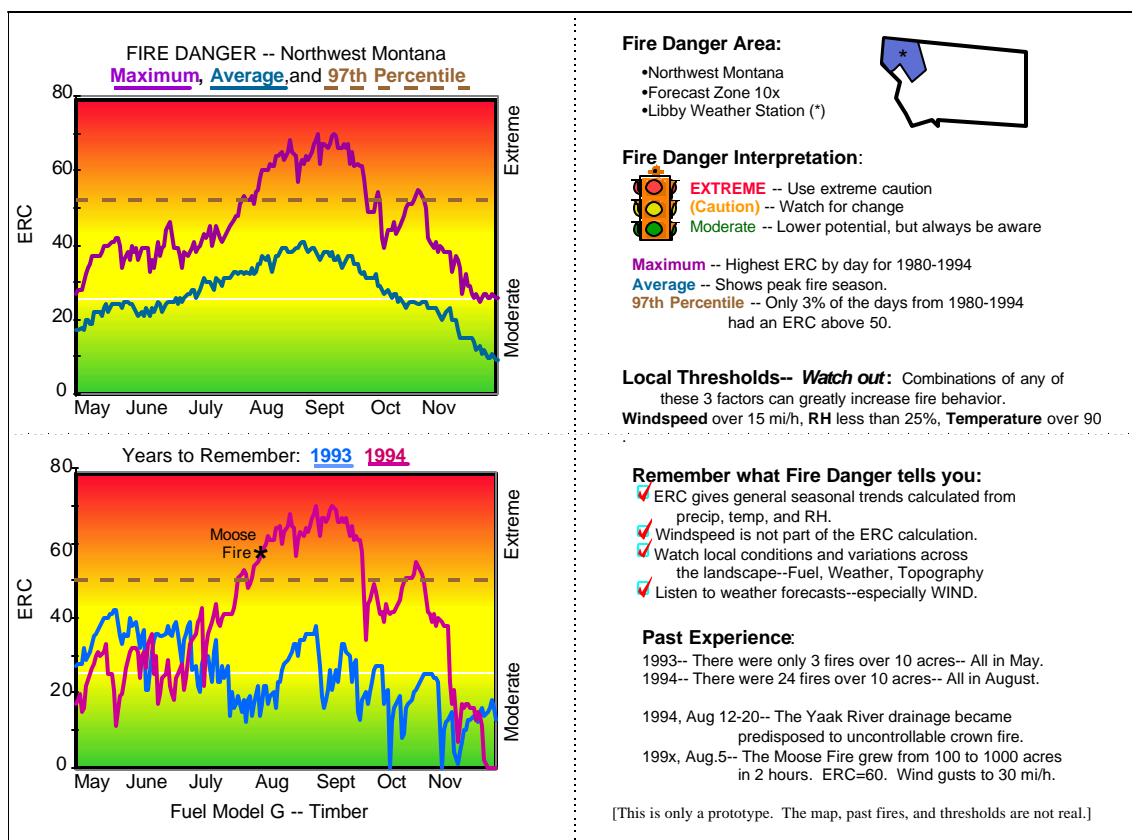
Current fire season - Fire danger for the current year to-date can be added to the card before it is handed out to firefighters, especially if the cards are used for out-of-region crews arriving in midseason. Alternatively the lines can be sketched on by the firefighter from a fire danger wall chart. As firefighters listen to fire danger indexes read over the radio, they can use the card to interpret the numbers that they hear The values can be plotted on the card

each day to track the fire season as it progresses.

Adjustment for local conditions - Reminders on the back of the card state that NFDRS gives a general assessment of fire potential for the area, that local conditions may vary, and that short term, daily or hourly weather changes can quickly change fire potential. Firefighters must continue to use experience and training to recognize on-site factors that affect fire behavior. Firefighters should listen to weather forecasts, especially with respect to wind—both direction and speed—and to elements of the forecast unique to the area. Critical thresholds for temperature, relative humidity, and wind may be given. These will generally be based on local experience (not necessarily on NFDRS).

## 5. SUMMARY

Firefighter safety is of utmost importance. The fire danger rating pocket card presented here is meant to increase awareness of fire potential through personal involvement of each firefighter. The card helps each firefighter evaluate the meaning of a key index value and to personally produce a visual display of the current season trend as provided by the National Fire Danger Rating System.



## 6. CARD PREPARATION INSTRUCTIONS

Instructions for card preparation can be obtained from the corresponding author at the time of this writing, the FIRES program and spreadsheet and presentation software are used. If the concept proves worthwhile, card production methods will be streamlined and automated.

## 7. REFERENCES

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